1972

# Equations Presented as an Example of a Nonsimulation Game

Layman E. Allen
*University of Michigan Law School*, laymanal@umich.edu

Joan K. Ross
*University of Michigan*

# "Equations" presented as example of a nonsimulation game

By Layman E. Allen and
Joan K. Ross
The University of Michigan

One way of characterizing instructional games is in terms of whether they are simulation games or nonsimulation games. Most of *Simulation Gaming News* deals with simulation games and other simulations; here we are concerned with nonsimulation games.

What are nonsimulation games? Why call them that? It should be evident at the outset that there is a sense in which the naming of anything is arbitrary. We certainly could have called what we're referring to **instructional** games or **educational** games. They do have properties that those names suggest. Or we could have called them **alpha** or **beta** games—names that have few relevant connotations.

Instead, we choose here to refer to them as **nonsimulation** games to emphasize their relationship to the class of games that includes most educational games—namely, **simulation** games. In characterizing this relationship we emphasize what players do when engaged in the play of these games, what choices they are faced with, what problems they are led to think about.

In simulation games, what players do and what they are led to think about are **representations** of problems (usually greatly simplified) in the subject field that the game is about—and they deal only with such representations of problems in the subject, never with actual problems. In the sense in which we are using the term, a simulation game is one that always only represents something else, usually a simplification of some complex piece of social reality. The game "Democracy," for example, represents a simplification of American legislative processes, and the game "Policy Negotiations" represents simplifications of a wide range of bargaining processes.

In one sense the name **nonsimulation** game could be misleading; it could be interpreted to refer to a game that is never a simulation. But we do not intend that meaning. Rather, we shall use the term to refer to games that are **not always** simulations. These are different from games that are **never** simulations.*

In what follows we present a series of introductory problems that can serve as an introduction to one nonsimulation game, "Equations." These problems are deliberately selected to be arithmetically trivial ones so that the game rules are emphasized at the outset and are not obscured by complex considerations of the subject matter. There will be plenty of opportunity for complex considerations later. Mathematics is a field rich in ideas. Subsequent columns will indicate how to probe more deeply into mathematics through the use of "Equations."

The game of "Equations" involves many skills—both of mathematical technique and of assessment of the techniques of others. The technical skills may be fostered by the use of game-connected puzzles. We shall give examples of several types of puzzles here.

"Equations" is played with cubes imprinted with arithmetical symbols. The cubes are rolled by the first player, who thereby generates the Resources for the game. He then uses one to five of the Resource cubes to set a Goal on a Playing Mat. The Goal is a number which is the right side of an equation. The remainder of the play consists of the players taking turns and placing constraints on the use of the remaining Resources in building a Solution.

The Solution is the left side of the equation and must be equal to the Goal. The constraints are placed by putting a cube (one per turn) in one of three sections of the Playing Mat: Forbidden, Permitted, or Required. The names are suggestive of the constraints—cubes played into Forbidden must not be used in building a Solution, cubes in Permitted may or may not be used, and cubes in Required must be used. In general players win by being involved in a challenge where one player (the Challenger) says to the player who has just moved (the Mover): "I Challenge you because I think your move was a Flub." A Flub is defined as a move which falsifies any one of the three following claims that a Mover implicitly makes with each move:

C—I CANNOT correctly challenge the previous move, because it was not a Flub.

A—If I can, I am AVOIDING by this move allowing a Solution to be built by the play of just one more cube from the Resources to the Permitted Section.

P—It is still POSSIBLE for the remaining Resources to be played so that a Solution can be built.

Thus a Challenger is asserting that the negation of one of the claims is true—and he must specify which. After a P-challenge, the Mover has the burden of proof and tries to build a possible Solution. For this he can use as many Resource cubes as he wishes while using cubes from the Mat within the imposed constraints.

After an A-challenge, the Challenger has the burden and tries to build a Solution with just one more Resource cube and cubes from the Mat. Who has the burden of proof after a C-challenge depends on the kind of Flub that was initially made. The highest score goes to players who sustain the burden of proof when they have it or who do not have the burden of proof when no one sustains it.

The conditional nature of the A-claim has the effect that if the only alternatives to moves that allow a Solution to be built with one Resource cube are moves that violate the P-claim, the former moves are not Flubs. Thus when one cube remains in Resources, the last Mover has usually not Flubbed. This is called a Force-Out, and any player who writes a Solution scores (though not as much as if he had been party to a Challenge and been correct).

A necessary ingredient of good play is an understanding of the definition of Flub. In order to help this understanding, players may be presented with a series of puzzles where the arithmetical skills are nominal so that understanding of the game rules is both a necessary and sufficient condition for success in doing the puzzles. The puzzles in the box on this page are examples. The order of the puzzles is chosen to introduce the ideas as they would naturally occur in the play of a game. We urge the reader to try to solve the puzzles before checking the answers, which are printed on the adjoining page.

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In the next issue we will examine a type of puzzle which leads students to consider the many alternative ways that a set of Resources can be used.

* * *

What are the 3 largest numbers that can be expressed with 5 cubes from the following set of Resources: + + - x 0 1 2 3 3 5 6 6 7

a) if no digits may be juxtaposed, i.e., no place value may be used

b) if at most 2 digits may be juxtaposed

c) if up to 5 digits may be juxtaposed.

Answers for this puzzle will appear in the next issue.

*(Editor's Note: The relation of the following footnote to the discussion above is conceivably nonsymmetrical. Readers are encouraged to consider the terminology proposed, and to comment in letters to *SGN*.) In our terminology, we intend to parallel that of logicians and mathematicians in describing the properties of relations. For example, consider the properties of symmetry, asymmetry, and nonsymmetry. A relation that is symmetrical is one such that if X has that relationship to Y, then Y always has that relationship to X. The relation "spouse of" is symmetrical; if X is the spouse of Y, then Y is always the spouse of X.

A relation that is asymmetrical is one such that if X has that relationship to Y, then Y never has that relationship to X. The relation "father of" is asymmetrical; if X is the father of Y, then Y is never the father of X.

A relation that is nonsymmetrical is one such that if X has that relationship to Y, then Y does not always have that relationship to X. The relation "brother of" is nonsymmetrical; if X is the brother of Y, then Y is not **always** the brother of X. (Y may be female.)

When we say that "Wff 'N Proof" is a nonsimulation game, what we mean to say is that it is not always only a simulation. We do not mean that it is never a simulation. With respect to the subject of logic—in particular, two-valued propositional logic—the player of "Wff 'N Proof" is not engaged in simulating two-valued logic. He is actually doing it. He is generating and solving problems in two-valued logic. Hence, "Wff 'N Proof" is not a simulation of logic; to play it is to do logic. Thus, because it is not a simulation with respect to two-valued propositional logic, it is not true that "Wff 'N Proof" is **always** only a simulation. But the fact that from some point of view it is not a simulation does not mean that it is **always not** a simulation, that is, that it is **never** a simulation.

It happens that two-valued logic can be viewed as a simulation of series parallel electrical circuits; playing "Wff 'N Proof," therefore, involves doing problems that are simulations of series-parallel electrical circuits. So "Wff 'N Proof" can be viewed as a simulation with respect to series-parallel electrical circuits, but from another viewpoint as not a simulation with respect to two-valued logic.

It sometimes is a simulation; it sometimes is not. It depends on the viewpoint. It is **not always** only a simulation. Hence, just as nonsymmetrical is an appropriate characterization for a relation that is **not always** symmetrical, so also nonsimulation is an appropriate characterization for a game that is **not always** only a simulation game. Just as "Wff 'N Proof" is a nonsimulation game in the sense that it is not always a simulation, so also are "Equations," "On-Sets," and "Queries 'N Theories" other examples of nonsimulation games. We do not know of any games that would be examples of "asimulation" games, that is, games that can **never** be viewed as simulations with respect to something else.

# "Equations" Flub Puzzles



**In the game situations below, it is your turn to play. The circled item indicates which cube was just moved. You should put a check in the appropriate blank to indicate what play you will make.**

(a) to Challenge, put a check in one of these blanks to indicate the kind of Flub.

___ A an A-claim Flub
___ CA a C-claim Flub stemming from an A-claim Flub

[For both A and CA Flubs, write a Solution that can be (or could have been) built by moving one more Resource cube to Permitted.]

___ P a P-claim Flub
___ CP a C-claim Flub stemming from a P-claim Flub

(b) to declare Force-Out, put a check in ___FO and write a Solution that can be built by moving one more Resource cube to Permitted.

(c) to move, put a check in ___Move (indicating that the previous move is neither a Flub nor a Force-Out situation).

(d) to indicate that you do not know what play to make, put a check in ___ ?

(1)
Resources: + 0 1 3 4
Forbidden:
Permitted:
Required:
Goal: ③

Challenge
___ P
___ CP Solutions
___ A _____
___ CA _____
___ FO _____
___ Move
___ ?

(2)
Resources: + + 1 2 3
Forbidden:
Permitted:
Required:
Goal: ⓪

Challenge
___ P
___ CP Solutions
___ A _____
___ CA _____
___ FO _____
___ Move
___ ?

(3)
Resources: + 3
Forbidden:
Permitted: 0⊕
Required: 3
Goal: 6

Challenge
___ P
___ CP Solutions
___ A _____
___ CA _____
___ FO _____
___ Move
___ ?

(4)
Resources: 1 4
Forbidden: ⊕
Permitted: 0
Required: 4
Goal: 8

Challenge
___ P
___ CP Solutions
___ A _____
___ CA _____
___ FO _____
___ Move
___ ?

(5)
Resources: + + 4
Forbidden:
Permitted: ⓪
Required: 2
Goal: 3

Challenge
___ P
___ CP Solutions
___ A _____
___ CA _____
___ FO _____
___ Move
___ ?

(6)
Resources: 3
Forbidden:
Permitted: ⊕
Required: 2
Goal: 1+4

Challenge
___ P
___ CP Solutions
___ A _____
___ CA _____
___ FO _____
___ Move
___ ?

(7)
Resources: 1
Forbidden: 4
Permitted: ③
Required: + 1
Goal: 2

Challenge
___ P
___ CP Solutions
___ A _____
___ CA _____
___ FO _____
___ Move
___ ?

(8)
Resources: + +
Forbidden:
Permitted:
Required: 1 2③
Goal: 6

Challenge
___ P
___ CP Solutions
___ A _____
___ CA _____
___ FO _____
___ Move
___ ?

# Flub Answers

(1) Challenge A. A Solution that can be built with one cube from Resources is 3. Goal-Setter could have set a Goal of 4 for which there was a possible Solution of 3+1. The conditional nature of the A-claim makes it rather difficult at times: It is *not* a Flub to allow a Solution with one more cube if the only alternatives are P-claim Flubs or other moves that allow a Solution with one more cube. It is also important for players to realize that to set a Goal that has a twin in the Resources is a Flub when there are other alternatives.

(2) Challenge P. No matter how the remaining Resources are played it will never be possible to build a Solution. Mover here would have the burden of proof.

(3) Challenge A. A Solution that can be built with one Resource cube is 3+3. An alternative move would have been to play + to Forbidden.

(4) Challenge P. No Solution can ever be built.

(5) Challenge CP. The Goal-Setter Flubbed in setting a goal for which no Solution was possible. The second player therefore should have challenged. After second player moved the 2 he could be challenged for not challenging Goal-Setter and now the player who moved the 0 can be challenged for not challenging second player. It would also be correct for Challenger here to specify a P-claim Flub. In this game the first player should have declared "No Goal" as there is no equation that can be built with the given Resources.

(6) Declare Force-Out. The Solution 2+3 can be built with one more cube from Resources. Mover did not Flub because he had no alternative: he must either violate the P-claim or allow the Solution to be built. The scoring of the game places a premium on being correct after a challenge. A game that ends in a Force-Out is usually a tie.

(7) Challenge CA. The Mover should have challenged because a previous Mover had allowed the Solution 1+1 to be built with one Resource cube when the alternative of moving 3 to Forbidden was still available.

(8) Move. No Flub has been made. Because the only possible Solution is 1+2+3 the move must be of + to Permitted or Required. The *next* player should say Force-Out.

After a class has gone through the set of these puzzles with a teacher, the teacher may obtain feedback on the class's understanding by giving them another set of such puzzles—but one in which the order is mixed up—and seeing how well they can answer. ●